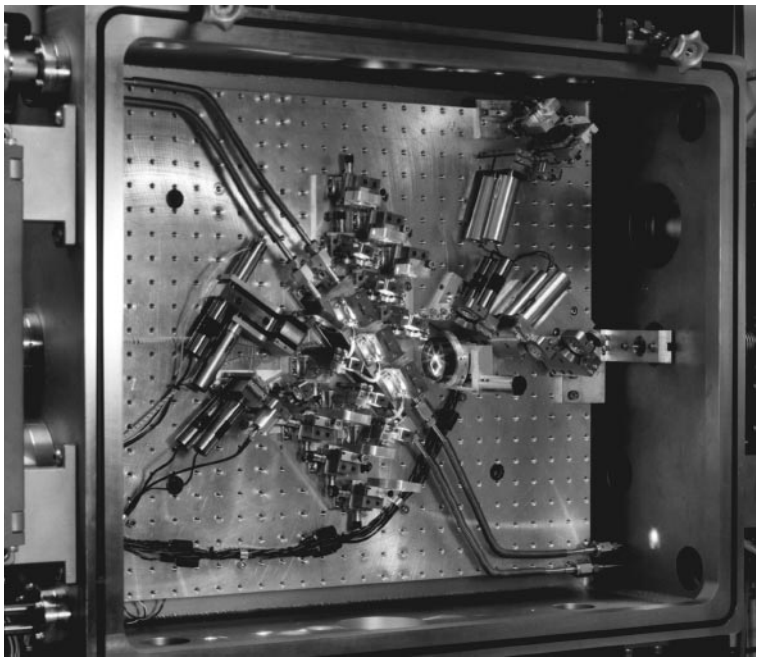
High-Average-Power Titanium:Sapphire Laser

LLNL design offers exceptional beam quality, high power, and broad tunability

The Isotope Separation and Advanced Manufacturing (ISAM) Technologies program at LLNL has developed the world's highest average power titanium:sapphire laser. It can produce more than 50 watts of tunable output in a diffraction-limited TEM00 mode beam. At these power levels, the tuning range of this laser is from 650 nm to more than 1000 nm, greater than thatof any available titanium: sapphire laser.



LLNL's titanium:sapphire laser operates for hundreds of hours at a time, with high reliability and minimum attention.

High reliability

Our titanium:sapphire laser has an exceptional combination of excellent beam quality, high power, and broad tunability. This has been achieved with a patented design that takes advantage of the unique high-thermal-conductivity of sapphire at low temperatures, combined with a special multi-rod resonator for power scaling. This laser can be pumped with cw argon-ion, pulsed-copper, or frequency-doubled Nd:YAG lasers. Our titanium:sapphire laser has regularly operated for hundreds of hours at a time, with high reliability and minimum attention, in an industrial environment during isotope-enrichment demonstrations.

APPLICATIONS

- *Precision materials processing*
- *Enriching medical isotopes*
- *X-ray lithography*
- *Polarized-ion source for research accelerators*
- *Beaming power to satellites*

Precision materials processing

The excellent beam quality of our titanium:sapphire laser in pulsed operation makes it well suited for precision laser materials processing. Other potential applications include enriching stable medical isotopes (such as Carbon 13, Oxygen 18, and Strontium 88), beaming power to satellites, and generating soft x-rays for x-ray lithography.

Our laser design has produced more than one watt of continuous-wave, frequency-doubled coherent light. Indeed, a much higher second-harmonic power output is expected when the system is optimized and used in the pulsed mode. High-average-power, mode-locked operation should also be possible with this laser. Because of its high-power output, our titanium:sapphire laser design is regarded as the laser of choice for the polarized-ion source at the Los Alamos Meson Physics Facility (LAMPF), and other accelerators throughout the world.

Availability: This patented technology is available now. LLNL is seeking industrial partners to commercialize the laser and its applications.

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